A Step by Step Guide to Writing a Scientific Manuscript

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Abstract

About 50% of abstracts presented at conferences get published as full manuscripts. This manuscript is a hands-on instruction on how to publish a scientific investigation. Criteria for authorship should be based on the International Committee of Medical Journal Editors Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication. The first step is always to read the Guide for Authors of the journal where you intend to submit the manuscript. Start the manuscript preparation by describing the materials and methods, including the planned statistical analysis (~1,000 words or less). This can often be copied from the study protocol. The second step is to describe the results (~350 words). The methods and results are the most important parts of the paper. When possible, use figures rather than tables to show your results. The discussion typically starts with a short overview of the most important results, followed by an assessment why the chosen design or model is appropriate. The discussion should place the results into contact, and present the clinical impact of the findings. The discussion should also acknowledge limitations of the study. The final conclusions should be low-key rather than exaggerated. The last step is writing the introduction (~350 words), the abstract, and the title page. Generic mistakes include failure to state a hypothesis, not answering the hypothesis, contradictions within the manuscript, superficial or rambling discussion, inconsistent use of terms, and a conclusion that is not supported by the data. In conclusion, writing scientific manuscripts need not be difficult or painful. With a little bit of organization, discipline, and persistence, writing manuscripts can be learned rapidly, thus producing excellent exchange of experience, personal success, and scientific progress.

Nothing looks as simple as an implemented idea.
Wernher von Braun, Engineer of the United States NASA Apollo Space Program

Introduction

Medical science consists to a large degree of discussion and exchange of experience and observations. These may occur via direct dialog among scientists, presentations at conferences, and by means of scientific manuscripts in peer-reviewed journals. Only 50% of abstracts presented at scientific meetings are published in peer-reviewed journals.[1] This is surprising, given that publication of manuscripts is used as a measure of academic success by investigators, their colleagues, their department chair, and those who fund their studies. This manuscript is intended to provide step by step instruction on how to write a scientific manuscript. The purpose is to provide a cure for "writer's block," and thus enhance a successful scientific career.[2] The audience for this manuscript is the junior academician who needs guidance on how to write a manuscript. There are many ways of tackling manuscripts, and this approach is merely one straightforward method. Although the envisioned manuscript is the research report, these same principles apply, *mutatis mutandis*, to review articles, brief reports, editorials, and case reports.[3]

Step 1: Read the Guide for Authors

Most journals have a Guide for Authors that is printed at least once yearly and is available online. *Anesthesia & Analgesia* offers an unusually comprehensive Guide for Authors, which appears yearly as a Special Article[4] as well as being available online.[1] Prior to preparing your manuscript, download and carefully read the Guide for Authors of the journal where you intend to submit your manuscript. There will be detailed information about the interest and scope of the journal, specific information about manuscript types, and detailed instructions on formatting your manuscript. Editors and reviewers notice when authors have not even bothered to read the Guide for Authors or flagrantly disregard instructions on manuscript preparation, style, and formatting.

Anesthesia & Analgesia also recommends that authors read "The Elements of Style" by W. Strunk and E.B. White.[5] This is a modest and inexpensive text that can be read in a few hours. It describes a very clear and succinct writing style that is appropriate for scientific publications.

Step 2: Write the Materials and Methods

The Materials and Methods section is the most critical part of the manuscript. It should describe what, *exactly*, you did in the study. Typically there is a handy document that already describes the materials and methods: the study protocol. Therefore, an easy and logical place to start is to cut and paste the study protocol into your Materials and Methods section.

The Materials and Methods section should typically consist of fewer than 1,000 words. A simple laboratory study might be shorter than this, while a protocol that introduces new methodology may require a very extensive explanation. The materials and methods should describe the study in sufficient detail so that a skilled investigator in the field could replicate the study. If the study uses previously published methodology, appropriate reference should be supplied. Often the material and methods will use methodology that has been previously used by the laboratory, for example a particular assay or experimental model. In this case, it is acceptable to adapt verbatim previously published material *by the same author*.[2]

If your study involves human subjects, always start with a statement about Institutional Review Board approval and informed consent. If your study involves animal subjects, always start with a statement about approval from the appropriate review board. Following these, describe your study population in explicit

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1 http://www.aaeditor.org/GuideForAuthors.pdf, last accessed August 4, 2009

2 Of course, it is never acceptable to copy text by another author without appropriate reference and the use of quotation marks if the text is copied verbatim.

detail. Typically this can be found in the study protocol. If the population is divided into multiple groups, these should be defined. It is easier to read a study if treatment groups are given clear names (e.g., the propofol group vs. the etomidate group) than simply given letters (group A vs. group B). If there is a random assignment of treatments, the randomization process should be defined.

After defining treatment groups, describe how the study was conducted in each group. Typically the description follows a temporal sequence, describing each step in order. Be certain to include all of the measurements that will be reported in the results. Any measurements that were taken to ensure the safety of subjects should also be reported.

After describing the treatments, describe the data analysis plan. This includes how the data were analyzed, including the statistical treatment of the data. *Consult a statistician to make certain that the statistical analysis is appropriate, and that it is accurately described in the manuscript* (Tables 2, 3). Start with a description of the power analysis that was performed (if any). That should be followed by a description of the statistical analysis of the primary endpoint, followed by a description of how secondary endpoints (if any) were analyzed. Complex or unusual analysis approaches should be explained in sufficient detail to permit a skilled statistician to reproduce your results from your data.

Avoid non-standard abbreviations. Unusual abbreviations make manuscripts very difficult to read. If you avoid introducing novel abbreviations in your Materials and Methods, then you are unlikely to introduce them elsewhere. Lastly, science is not a passive process conducted by automatons, but rather a personal adventure of exploration and discovery. It is appropriate to share the humanity of your journey in your manuscript with occasional use of the first person when describing what you did. First person narrative, in limited doses, also makes the manuscript more lively and engaging.

Step 3: Describe your results

The results are the second most important part of your manuscript. Now that you have described what you did (the Materials and Methods), you should next describe what you found. Look at the scientific reports in *Science* and *Nature*. The reports succinctly describe what the investigator did (the Methods) and what the investigator found (the Results). There is very little Introduction and Discussion, because nobody cares about that. Your scientific peers care about what you did, and what you found.

The organization of the results should be parallel to the organization of the methods. Start by describing your population: how many subjects, how many protocol failures, the demographics of the individual groups, etc. Then describe the outcome of your primary variable. That is followed by describing the outcome of your secondary variable. Do not interpret the results – that is the purpose of the discussion.

Typically investigators initially prepare the tables and graphs from their study, and then write their results as a tour of the graphs and tables. That is an efficient way to proceed. The importance of visual presentation of the results cannot be overstated. In virtually every analysis there is a way of presenting the results that is graphically compelling. Conversely, if there is no graphical means of presenting the results, then it is unlikely that the results are of any significance.

Assemble your results in a manner that is understandable at first sight; if you cannot explain it to your mother, then you do not understand what you did. Figures and tables need to be self-explanatory. The reader should not be forced to go back and forth between the text and the table or figure to interpret it. Do not expect readers to pick up trends in large tables. Trends should always be displayed graphically. There is no “right” number of tables or figures. Too few figures may not show enough of the results to fully communicate the findings. Too many figures may obscure the important results. However, if you have no

figures, then you probably do not have an interesting result.

Graph ALL your data whenever possible. There is a tendency for investigators to graph means and standard errors (if showing dispersion of the data) or standard errors (if comparing the means). However, often it is possible to actually display all of the data, not just the mean and the error bars. If there is a way to show all of your data, do it.

Use brief but descriptive legends, and define each abbreviation in each table/figure. Clearly annotate differences in the figures. Provide a column of *p*-values for comparisons, and list the actual value instead of merely "*p*=NS." Let the reader decide if differences are important or if "trends" really exist.

As you write your results, it is appropriate to include in your text the important elements of each table and figure. It is obviously redundant to list 10 demographic variables in a table, and then repeat these numbers in the text. However, if a few are interesting, then state the interesting numbers in the text.

Step 4: Discuss your findings

The discussion is where you place your findings in the broader scientific or clinical context. Many authors write lengthy discussions, considering their results from every possible angle, followed by a mini review of the literature. Although some editors may like this approach, in the opinion of *Anesthesia & Analgesia* an extensive discussion is a waste of time. What is important are the Methods and the Results. What the author thinks about it is less interesting.

The discussion should consist of about 1,000 words or less. Before writing the discussion, determine which topics are important.[6] Start with a brief description of the main findings (maximum three sentences) to give the reader a quick orientation. Subsequently, defend your model and explain the rationale for your study methodology. For example, this is a good place to justify your dosages, your protocol, your inclusion and exclusion criteria, and why you chose a specific data analysis approach.

The next step is to place your key findings into scientific and clinical context. Typically this should be no more than a few paragraphs. This is where you would present what other investigators have observed, and why your results either confirm or refute prior observations. This is also the place to present statistical vs. clinical significance.[7] At the end of this section, discuss the impact of your results on clinical practice or patient outcome.

Following this, review the limitations of your study. No study is perfect. What are the pitfalls of your methodology, your study population, your study power, or the presence of confounding and uncontrolled variables?

End your discussion with realistic conclusions, preferably in one or two sentences. Understate your conclusions, as overblown or speculative conclusions will draw the ire of reviewers and letters to the editor from annoyed readers. Finally, end with a sentence or two about "next steps" to continue this line of research.

There are several pitfalls to avoid when writing your discussion. Do not claim to be first. That only invites angry letters from others who believe their results should have primacy. Do not ramble. Do not review the literature, other than review what is necessary to place your results into context and properly acknowledge key previous efforts in the field.

Step 5: Write the introduction

The introduction should explain why you did the study, and why anyone should care about the findings (the "so what?" question). The introduction should be no more than a double spaced typed page. First, describe the basic clinical or scientific question of interest. Describe what is unknown about the question. Then, state the population in which you plan to study this question (i.e. elderly patients, rat dorsal root ganglion cells), and the key measurements required to answer the question. Conclude your introduction with a clear

statement of your primary hypothesis, followed by your secondary hypotheses (if any).

The introduction needs to be written concisely and has to immediately attract the reader. If the introduction does not instill any enthusiasm in your study, it is unlikely that a journal will consider publication. The importance of stating a clear hypothesis or study aim at the end of the introduction cannot be over emphasized, as that is one of the core points of the entire manuscript. Of course, even though you state the hypothesis late with this writing strategy, the hypothesis needs to be defined before the study.

Step 6: References

The references demonstrate that you understand how your findings relate to earlier reports. You can safely assume that your reviewers will be the authors of the papers you reference.[8] Do not cite papers if you have only read the abstract, because reviewers can tell if you have misinterpreted their work. Format your references as required by the journal. Sloppy references suggest that your study was also performed in a sloppy manner. Carefully read the guide to authors for the journal you plan to submit to, as this ensures that the manuscript including sections and references are properly formatted. Endnote® or WinWord® allow these functions with little effort and should always be used.

Step 7: Write the abstract

Only after the manuscript is complete you should write the abstract. Again, consult the Guide for Authors to make certain that your abstract is properly formatted. *Anesthesia & Analgesia* requires structured abstracts for all research reports, consisting of background, methods, results, and conclusions. Be certain to stay within the word limit. Years ago the limit was set by Medline, but the Medline limit is currently 10,000 words. *Anesthesia & Analgesia* limits abstracts to 400 words, which is mostly set to properly balance the length of the abstract against the length of the manuscript.

Preparation of the abstract should be straightforward. All components appear in the body of the manuscript. As succinctly as possible, present the background (one sentence), the key components of the methodology, and the key results. Since many online readers can only obtain your abstract, be certain to include enough information that your manuscript results are useful to them. That includes presentation of key numeric results (both mean and variance).

Step 8: Create the title page

Title pages are becoming increasingly complex, as editors strive to comply with the multiple requirements for disclosure of funding, conflicts of interest, open access requirements for several funding agencies, and other challenges. *Anesthesia & Analgesia* offers an on-line site to create the title page.[3] Other journals may follow suit. Be certain that the title page contains all of the information required by the journal.

One of the main components of the title page is the list of authors. Editors of important international peer-reviewed journals have defined authorship criteria for a scientific manuscript, most recently in the 2008 "Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication.[4] (Table 1) Authorship is also discussed extensively in the 2009 *Anesthesia & Analgesia* Guide for Authors.[4] Authorship rewards a scientist for his or her work, but also incurs significant responsibility for the integrity of the data, the data analysis, and the interpretation of the data in the manuscript.[9] Unfortunately, varying interpretation of these rules is frequent, often resulting in disagreements, debates, and occasional scandals.[10, 11, 12, 13, 14] Any dilution of

[3] http://www.aaeditor.org/Authors/home.html, last accessed August 4, 2009

[4] http://www.icmje.org, last accessed August 4, 2009

academic credit[15] from unearned authorship is unacceptable.

There are many arguments put forward to justify unearned authorship, including "I was around at the time of the study," "It is my topic," "I suggested the study," "The paper will not be published without my name on the author list," "As your department chair, I am the one who made it possible for you to do this study," and "I need authorship for my promotion." The most egregiously abusive practice is the department chair who demands authorship because "I am the one who made it possible for you to do this study." Fortunately, changing standards of academic integrity now mean that the hundreds of unearned authorships on the curriculum vitae of some department chairs have become a source of academic shame rather than academic pride for both the chair and the institution.

There is also an inverse problem, where authors do not wish to see their names included, lest their involvement impairs the chance of publication. This may be the case with papers from the pharmaceutical or device industry, in which scientists who have analyzed the data, and perhaps written the paper, are not acknowledged because they are employed by the study sponsor. This is also dishonest. Authors are those who make intellectual contributions to the work. If there is a conflict of interest, that needs to be disclosed, but a conflict of interest, including employment by the study sponsor, does not preclude the requirement that the authorship list accurately reflect the individuals who contributed tot he manuscript. Because of the political nature of authorship disputes, experienced colleagues and mentors must vigorously defend junior authors from transparent violations of authorship requirements.

Step 9: Screen for the Rapid Rejection Criteria

The "Rapid Rejection Criteria" are mistakes that typically result in immediate rejection. The Rapid Rejection Criteria are:

1) The question being asked is not interesting;
2) The question being asked has been adequately answered already;
3) The question being asked has not been previously asked, but the answer is obvious from what is known in the field;
4) The hypothesis is wrong (usually reflecting inadequate preparation);
5) The methodology cannot possibly address the hypothesis;
6) The study is obviously underpowered;
7) The manuscript does not answer the hypothesis;
8) The manuscript contradicts itself;
9) The conclusion is not supported by the data.

Although they may not be specifically enumerated, journal editors and reviewers typically have a mental list of Rapid Rejection Criteria that they use to quickly dismiss troubled manuscripts (Tables 4, 5).

Similar to the Rapid Rejection Criteria is the "Worth the Space" question: is the information communicated in the manuscript worth the effort to read the paper? For example, most *Anesthesia & Analgesia* readers do not work in university hospitals. They are practicing clinicians. The readers (and the reviewers and editors) are interested in papers that address important questions in their professional lives. A paper that wastes their time with a long exposition on an uninteresting topic has stolen their time. It has also taken valuable time from the reviewers and editors. Most research studies can be adequately described in 3,000 words. A paper that violates the "worth the space" rule suggests that the authors are excessively enamored of their own work.

It is also critical to changing terms for identical items. For example, fluid resuscitation, volume replacement, and infusion management describes similar concepts. A paper that uses these terms interchangeably will leave readers confused.[16] For authors who are not fluent in English, it is absolutely essential that they have an editor who is fluent in scientific English read their paper before submission.[17] Many journals, including *Anesthesia & Analgesia*, strive to not have language issues impair the peer review process. However, when a reviewer struggles to read the paper, the annoyance of struggling to parse poorly written English will likely reduce the reviewer's enthusiasm for the manuscript. Lastly, always employ an electronic spell-check as one of the final steps. Spelling errors are a sign of sloppiness, and a sloppy manuscript implies sloppy research.

Step 10: Rewrite your manuscript

Now that you have written your manuscript, *rewrite it*. Be your harshest critic. Read the manuscript aloud to yourself and listen for any abrupt jumps in the logical flow, any unsupported statements.[18] Read each sentence word for word. Did you leave out the word "not" in the sentence "these results do support the use of drug X"? Would it be clearer to change the name of "Group B" to "Group Vasopressin"? Is there an unnecessary figure? Paragraph? Word? Rip into your paper as viciously as you can, and fix every little detail you can find. Once you have parsed your paper to the most succinct possible text, it is ready to share with your coauthors.

Step 11: Circulate your manuscript

All authors are responsible for the content of the manuscript. Now that you have an initial draft of the paper, circulate it to all of your coauthors (typically with all tables and figures included in a single electronic document) to collect their criticisms and obtain their approval for submission. The co-authors should confirm receiving a readable manuscript, and provide constructive criticism promptly. The tougher the critique, the better the co-author! If a coauthor simply says "everything is OK" they have not read the paper. A coauthor who cannot be bothered to contribute more than "everything is OK" has not taken the intellectual ownership of the material required of coauthors. If they cannot be bothered to critique the papers, remove them from the authorship list.

It is often useful to also have an interested senior scientist in your institution review the paper and offer editorial suggestions. Every paper, regardless of the skill and experience of the author, benefits from the editorial suggestions of another reader. *Science* and *Nature* recommend that authors ask peers from outside their discipline to read manuscripts before submission to improve the readability of the text. When extrapolating this to our field, an anesthesiologist with an interest in pain should immediately be able to understand a manuscript about perioperative vasopressor strategies.

This is also a good time to "test drive" your manuscript with an audience. Presenting your results in a division, department, institutional, or regional conference is an excellent way to obtain feedback from many observers. Methods or results that they find confusing will likely be confusing to your reviewers as well.

Prepare yourself for a massive revision once you have obtained feedback from all your coauthors and colleagues. If your coauthors have done their job, nearly every sentence will need attention, as will the figures, tables, and logical flow of the paper. That's OK! If your coauthors tear the paper apart before you submit it, the result will be a better paper. If the coauthors don't tear it apart, it is likely that the reviewers will, and the result will be a rejection.

Even the most carefully prepared manuscript may require two or three rounds of review between the first author (with the assistance of the senior author) and the

coauthors. A final review should be performed by the first author before submission (Table 6).

Common questions

1. Where should I submit my manuscript?

This decision can make or break of a scientific career, resulting in either fundamental frustration, or joy and success with scientific work. The first and most important goal is to write an excellent manuscript. No journal is ever impressed by a sloppily prepared manuscript. Also, forget rumors that co-author Dr. XY has a friend who can ensure publication of an inferior manuscript in highly-ranked peer-reviewed journals. It doesn't happen.

It is better to consider who could be interested in your results. A regional anesthesia project in the operating room may not be very interesting to *Critical Care Medicine*, but if you showed that your management resulted in a shorter stay in the intensive care unit, then such a study may have a chance. Further, check where similar studies have been published. For example, the *New England Journal of Medicine* usually does not publish animal studies. It would be useful to know that before spending many hours preparing your submission for them.

Many authors overestimate the importance of their results, resulting in futile submissions to journals such as the *New England Journal of Medicine, Lancet, JAMA,* etc. It is therefore better to publish a manuscript in a peer-reviewed journal in your own specialty than to hope for a magical acceptance elsewhere. For example, we published experimental work and case series about vasopressin in anesthesia, critical care, cardiovascular, and neurological journals for many years before we finally published a multicenter clinical trial in the *New England Journal of Medicine*.[19] It is better to be a productive academician, with multiple incremental contributions, rather than holding back hoping for a grand slam manuscript that will impress your promotions committee.

Most journal give you the opportunity to suggest reviewers, or to suggest that some reviewers should not be used because of academic competition or pre-existing bias. You should consider including such recommendations, where appropriate, as this may improve the likelihood of publication.[20] Remember, though, that your suggestions are only advisory. Editors are free to use any reviewer of his or her choosing.

2. The journal has requested a revision. What should I do with the reviewers' comments?

First, it is important to interpret the decision letter correctly. Editors tend to be very conservative in their decision letters. They also try to be very polite. If the decision letter requests a revision, it is important to realize that the editor has truly not made a decision. The editor believes the reviewers have identified significant concerns, and they want to give the author a chance to respond. Take it!

It is common to be angry with the reviewers. After all, you submitted a paper that you thought was nearly perfect, and they have written pages of criticisms. We can state from personal experience that the most important papers are those that receive the most extensive reviewer critiques! If your paper rehashes a well-known problem, there will be little controversy. Either it is a good paper, or it isn't. However, if your paper introduces new methodology, fundamentally challenges existing beliefs, and may result in a paradigm change, then you can expect your appropriately skeptical reviewers to challenge you on every point. That is exactly what peer reviewers do. Their challenge will either prevent you from embarrassing yourself by publishing a flawed manuscript, or help hone your manuscript into the cutting edge paper you believe it to be. They have devoted their time and expertise, usually with no possible reward, to help you.

Assume that your reviewers are experienced in their respective field, and are also experienced at assessing manuscripts.[21] Based on that experience, revising your

manuscript to address their concerns will result in a better paper, even if it is ultimately rejected from that specific journal. Revising a manuscript costs a lot of time and effort. It may even require additional experiments (which always impresses both your reviewers and the editor). However, the revision will be better than the initial submission.

The next step is to look at the editor's and reviewers' comments to determine whether the questions can be easily answered. For example, in a comparison of 2 x 10 animals we were once asked by an editor to add an additional 34 pigs to each group, which was impossible because the radioactive isotopes for blood flow measurements were unaffordable with our resources. We decided that we could not address this request, and resubmitted the paper elsewhere. However, we still incorporated all of the reviewers' suggestions to improve and clarify the text. We did that both because the paper was truly better with their recommendation, and also because there is a high likelihood that at least one of the reviewers for the second journal would have been a reviewer for our first submission.[22] Nothing annoys reviewers more than seeing a paper a second time, and having none of their suggestions from the first review incorporated into the revision.

You must also prepare a detailed point-by-point response letter explaining how you have addressed each item raised by the reviewer. Sometimes this letter is longer than the manuscript itself. If you have made the change, thank the reviewer for the suggestion. If you have not made a change, then you need to explain to the reviewer why you have not done so. Lastly, highlight changed text in the revised manuscript to make it easier for the editor and reviewer to see how you have revised the paper. Most journals provide very explicit instructions on how to do this.

3. What do I do after a manuscript is accepted for publication?

Congratulations! Share the good news with all parties involved, and take this opportunity to thank everybody for their efforts. This is also a good opportunity to forward the accepted manuscript, and the accompanying acceptance letter, to your department chair.

The "galley proofs" are the camera-ready copy of your manuscript. They will be sent to you to make certain that the manuscript has been accurately typeset. It is absolutely your responsibility to read the galley proof word for word to ensure it is accurate. Make certain that you also read the authorship list, the author affiliations, the conflict of interest disclosures, and the legends to every figure. This is your one and only chance to make certain that the final printed manuscript is correct. If you fail to identify errors on the galley proof that is sent to you, you may find the journal very unsympathetic when you subsequently request a correction of errors that you didn't catch.

Once the manuscript is published, send copies to all co-authors and never underestimate the power of a personal thank-you note to (non-academic) colleagues mentioned in the acknowledging section.

4. What is the "best" strategy for writing manuscripts?

We developed the aforementioned approach of writing articles over many years when coaching our M.D. and Ph.D. trainees, and it has worked very well, especially with inexperienced authors. However, we do not intend to position this strategy as the exclusive way of doing things, as different methods may also lead to excellent manuscripts. For example, another strategy is to start by creating graphs of your data and giving presentations to laboratory, departmental, and extramural colleagues, as this helps to identify methodological inconsistencies, hones your presentation with an audience unfamiliar with

the field, and allows feedback from future reviewers, all of which improve the draft of the manuscript. The description of the results is followed by writing the results, and then the methods. Afterwards, the introduction is written to explain why you did the study in as few words as possible. Subsequently, send the manuscript without the discussion to friends, colleagues, and collaborators to get feedback what works, what needs help, what is clear, and what seems opaque. Finally, the discussion is added followed by the abstract (make it terse, but useful). Let the feedback from your presentations, conversations with colleagues, and conversations at your poster on scientific conferences guide your discussion.

Regardless of the strategy being employed, most editors-in-chief do not like long discussions. The mindless rambling of an author who cannot focus annoys both reviewers and editors. In contrast, articles in *Science* and *Nature* focus fundamentally by describing 1) what you did, and 2) what you saw. These journals are minimally interested in the author's opinion as expressed in the discussion. As a general strategy, keep the manuscript (especially the discussion) as short as you can.

Conclusions

Writing scientific manuscripts need not be difficult or painful. With a little bit of organization, discipline, and persistence, writing manuscripts can be learned rapidly, thus producing excellent exchange of experience, personal success, and scientific progress.

Acknowledgments

The authors have coached a total number of 40 M.D. thesis students and 10 Ph.D. students, and published about 300 peer-reviewed manuscripts. Dr. Wenzel is section editor in *Anaesthesist*, *Notfall & Rettungsmedizin* and serves on the Associate Editorial Board of *Anesthesia & Analgesia* and in the Editorial Board of *Resuscitation*. Drs. Wenzel, Dünser and Lindner serve as reviewers for various international peer-reviewed journals. We would like to thank the thoughtful comments of the peer reviewers of the present manuscript.

Table 1.

2008 International Committee of Medical Journal Editors Statement on Authorship Requirements (verbatim)
Authorship credit should be based on 1. substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; 2. drafting the article or revising it critically for important intellectual content; and 3. final approval of the version to be published. Authors should meet conditions 1, 2, and 3 Acquisition of funding, collection of data, or general supervision of the research group alone does not constitute authorship. All persons designated as authors should qualify for authorship, and all those who qualify should be listed. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content. Acquisition of funding, collection of data, or general supervision of the research group, does not justify authorship. This indicates no automatic authorship for technicians, students, coordinators, or chairmen; an active contribution is always required.

Table 2.

Websites for Literature Search, Simple Statistics, Power Analysis, and Analysis of Citation Frequency
• Literature search: http://www.ncbi.nih.gov/entrez/query.fcgi • Fisher's-exact-test: http://www.matforsk.no/ola/fisher.htm • Chi square test: http://www.psych.ku.edu/preacher/chisq/chisq.htm • Power analysis: http://www.math.yorku.ca/SCS/Online/power/ • Science citation score: http://isi6.isiknowledge.com/portal.cgi/portal/Images/wok3_home.css • International Committee of Medical Journal Editors: http://www.icmje.org/

Table 3.

Statistical problems in scientific manuscripts identified by Mullner and colleagues.[23]
• 1 in 10 studies did not explain analyzed variables • 1 in 9 studies did not describe statistical analysis • 1 in 2 did not report units of measurements • Less problems with a statistician as co-author • Less problems in journals with an impact factor >9

Table 4.

Reviewer Errors in Assessing a Fictitious Manuscript About the Effects of Propranolol on Migraine Headache, from Baxt and colleagues:[24]
Incorporated mistakes
• No definition of migraines • Randomization: Flipping a coin at midnight • Visual analog scale (VAS) in six instead of 10 increments • No questions asked about concomitant therapy • Report of statistical significance, but non-significant *p*-values • No mention of approval by an institutional review board • No monitoring of unexpected events • 100 patients were examined, 87 treated, 10 excluded, what happened with the remaining 3? • "Youngest" reference was 8 years old
Recommendations of reviewers
• 15 reviewers accepted the manuscript for publication, 117 rejected it, and 67 recommended revision • 68% did not recognize discrepancies between the data and conclusions

Table 5.

What reviewers look at (our experiences, and adapted from Hoppin[21])
• Is the manuscript important? • Is the "So what?" question (what is changed by this manuscript?) answered? • Are there ethical problems with the conduct of the trial? • Are statements adequately supported, either by the data or by references to the existing literature? • Are the conclusions adequately supported by the data? • Are the conclusions believable? • Is the manuscript readable? • Does the paper make extensive use of jargon or introduce unnecessary abbreviations? • Is the presentation of the manuscript consistent with the journal style?

Table 6.

Manuscript checklist
☐ Spell check has been performed.
☐ Text is left justified.
☐ The numbers in the Abstract are consistent with the numbers in the Results.
☐ The Results section report of the measurements described in the Materials and Methods section
☐ Read the manuscript aloud to yourself. Does everything read smoothly? Is it easy to understand? Does something sound odd in terms of language, presentation, facts, or context?
☐ The manuscript addresses the "So what?" question? (Why should anyone care about this paper?)
☐ Limitations are discussed at the end of the discussion.
☐ The study answers the question posed in the introduction.
☐ The manuscript is consistent (e.g., the abstract, introduction, results, discussion, tables, and figures are internally consistent).
☐ The conclusions are supported by the data?
☐ The conclusion in the abstract is the same as the conclusion in the discussion.

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